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Operating Instructions

HD2 – Mobile Moisture Meter

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The HD2 is a portable device which serves for the display of measurement values delivered by Trime moisture measurement sensors and was designed for mobile field deployment.

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User Manual Portable Measuring Instrument HD2
Version April 2011

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1 General Notices

Please read the operating instructions carefully.

Should you have any further questions, please contact our service department under the contact data depicted above. In no event should you attempt to open and repair the device yourself. Should you like to file any guarantee claims, please contact the distribution partner where you purchased the device. Within the scope of product improvements, the device is subject to technical and optical changes.

1.1 Intended Use

This portable measuring instrument was designed to serve as a reading device for various IMKO probes. Only respectively intended probes may be connected to the device. The connection of a probe not intended for connection may lead to the destruction of the device and/or the connected probe.

1.2 The Chargeable Accumulator

Never exchange the integrated accumulator yourself.
The stated maximum operating periods refer to ideal conditions. The ambient temperature and the charging cycle can significantly reduce the performance time. In addition, the charging capacity reduces itself for technical reasons within the course of the utilisation of the device or due to storage at very high or low temperatures.

1.3 Charging the HD2 Portable Measuring Instrument

Only deploy the respectively provided charger or a comparable power supply unit to charge the HD2 port- able measuring instrument. Any deviation of the charging voltage can lead to damage to the device.

Should the device heat up during the charging process, this is normal and not connected with any hazards. Should the HD2 only function for a short period or not at all in spite of several attempts to charge it, the integrated accumulator is defective and must be exchanged. In this case, please contact our local distribution partner or us directly.

1.4 Temperatures and Ambient Conditions

The HD2 portable measuring instrument was designed for deployment under rough conditions.

The operation of the device under conditions beyond those depicted may lead to damage to the same.

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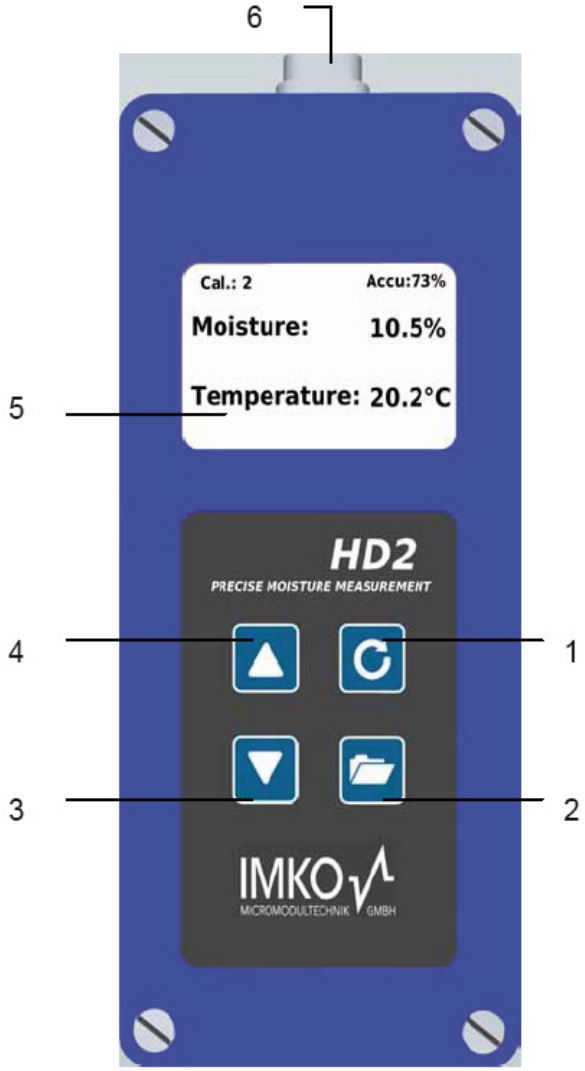
2 Control Elements

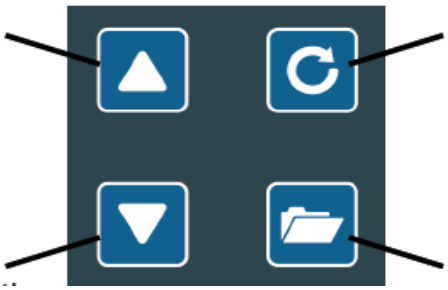
1. Button „Measurement“
2. Button „Menu“
3. Button „UP“
4. Button „DOWN“
5. Display
6. Probe/Charger Connection



2.1 Short Overview of the Key/Button Functions:

„UP“

- Selection of Menu Item/ Setting



„Measurement“

- Performance of a Measurement
- Selection of Menu Item
- Storing and Activation of a Setting

„DOWN“

- Selection of Menu Item/Setting
- Deletion of the Value Memory (only for operation mode „Average Value“)

- Power On / Off „Settings“
- Concluding settings
- Leaving a Menu Item

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3 Initial Commissioning

3.1 Safety Instructions

Attention: Before initial commissioning, do not fail to read the General Notices, Item 1 at the front of these operating instructions. Any not intended use may lead to damage to the device.

3.2 Checking the Delivery Scope

HD2 Portable Measuring Instrument Plug-in Power Supply Unit (12V/2A) Charging Adapter Protective Hood Manual

3.3 Charging the Accumulator

The integrated accumulator should be charged before putting the device into operation the first time. For this purpose, plug in the provided charging adapter into the 7-pole socket of the HD2. Subsequently, connect the plug-in power supply unit to the charging adapter. In the event that the device is already switched on, or if the accumulator is exhaustively discharged, the charging process will commence immediately. If not, switch on the HD2 by pressing the button „Measurement“ for approximately 1 second. An active charging process is signalised in the display by an animated accumulator symbol.

The integrated charging electronics charges the accumulator until the same is completely charged. In case of exhaustive discharge, this will approximately take 2 hours. As soon as the charging process is concluded, all 4 „accumulator bars“ will be permanently presented in the display and the trickle charging will commence.

Attention: Only charge the accumulator at room temperature (approximately between 10°C and 30°C)! At too low temperatures, it may happen that the charging concluding shut- down does not operate safely and the accumulator is over-charged. Too high ambient temperatures may lead to damage to the HD2 due to the additional heat-up during the charging process.

3.4 Connecting a Sensor

The HD2 portable measuring instrument can be operated with the following IMKO-moisture probes: Pico 64 Pico 32 Pico IPH

Connect the moisture probe to the HD2 by plugging in the 7-pole plug into the respectively provided socket at the HD“ and fastening the coupling nut.

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4 Operation

Key/Button Designation:

Key/Button	Designation
	Measurement - Shutting ON/OFF-→ press 1s - Perform Measurement→press shortly - Selection of a Menu Item→ press shortly - Storing a setting→ press shortly
	Settings - Conclude Settings - Leave Menu Item
	UP - Back to previous Menu Item or Setting
	Down - Go to next Menu Item or Setting - Deleting the Value Memory (Mode – Average Value)

Display Symbols:

Symbol	Designation
	Residual Accumulator Capacity
	Active Measurement
	Settings are stored
	Intensity of the Background Illumination
	Remaining time until shut-down (illumination / APO)
	Press button „UP“
	Press button „DOWN“

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Text Meaning:

Text (German/ English)

Meaning

Kal.: Number of the active calibration in the probe
Cal.:

Feuchte: Moisture Measurement Value
Moist.: Notice: Depending on the set calibration, the measurement value may refer to %vol, %grav or ns

Temp.:
Temp.: Temperature

EC-Trime: Radio-based-Conductivity

Seriennr.: Serial Number of the probe, respectively of the HD2
Serialno.:

HW: Hardware Version

FW: Firmware Version

4.1 Switching ON the HD2 Portable Measuring Instrument

Switch ON the HD2 by pressing the button „Measurement“ for approximately 1 second.
During the starting-up process, the HD2 will attempt to communicate with the connected probe. This will take approximately 4 seconds. If no probe is connected, or the probe is not able to communicate for any reason, an error message will be generated on the display. If the probe was successfully detected, the accordingly set background of the operation mode will appear on the display and the HD" is ready for deployment.

Notice: Should no connection to the probe be possible in spite of several attempts, check if the probe is connected properly. Should this not deliver a positive result, please contact our service department.

4.2 Switching OFF the HD2 Portable Measuring Instrument

Switch OFF the HD2 by pressing the button „Measurement“ for approximately 1 second.
Notice: It is not possible to shut off the HD2 while it is in the „Settings“. Please, first leave the menu item „Settings“ by pressing the button „Settings“ until the measurement display appears.

4.3 Measurement

The HD2 portable measuring instrument disposes of three operating modes:
1. Normal → ndividual Value Display – presents the measurement variables Moisture, Temperature and the EC-Trime
2. Average Value → presents the average value of the moisture of up to 6 individual measurements
3. Continuous Measurement → continuously measures the measurement variables Moisture, Temperature and the EC-Trime

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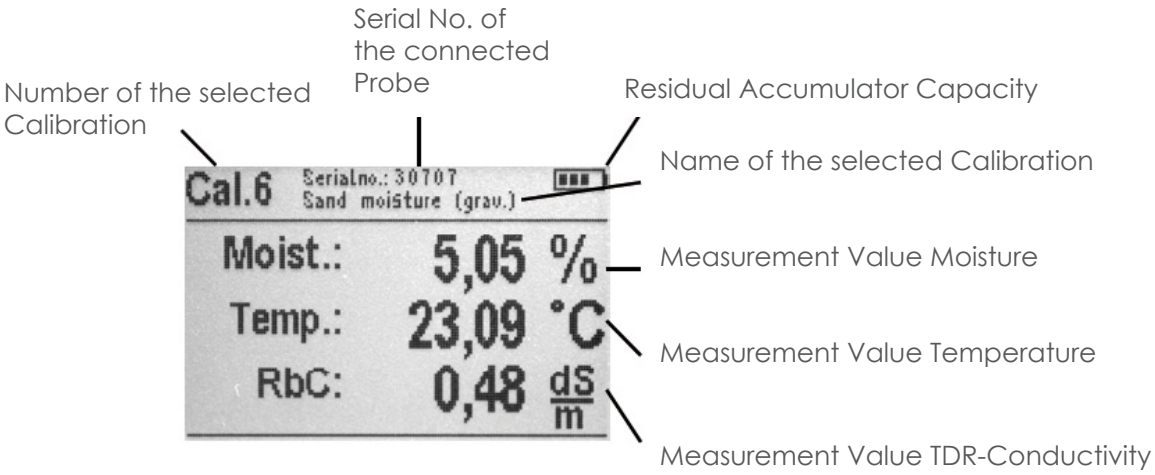
Notice: During a measurement, no further actions are possible. It is necessary to wait until the measurement is concluded.

4.3.1 Operating Mode „Normal“

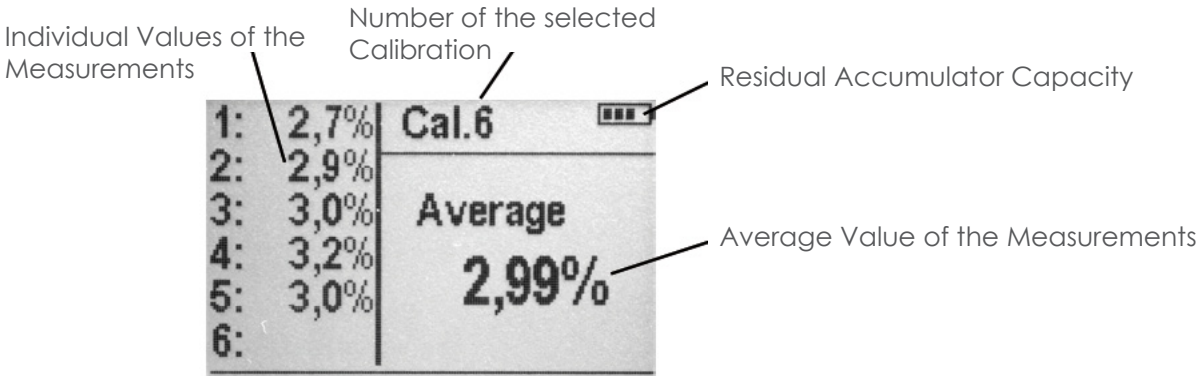
After switching on the HD2 portable measuring instrument, the following display will appear in the operating mode „Normal“ after the start screen:



In order to initiate a measurement, shortly press the button “Measurement” . The measurement will commence and a turning symbol will appear instead of the accumulator-symbol in the upper right hand corner. During this period, no other actions can be performed. The measurement requires approximately 4 to 5 seconds. Once the measurement is concluded, the accumulator-symbol will reappear and the measured values will be generated on the display. The display of the values will be maintained until a new measurement is conducted.

4.3.2 Operating Mode „Average Value“

In this operating mode, only the moisture is measured and an average value of up to 6 individual values is evaluated. Depending on the set calibration, either the volumetric or the gravimetric moisture is presented. After switching on the HD2 portable measuring instrument, the following display will appear in the operating mode „Average value“ after the start screen:



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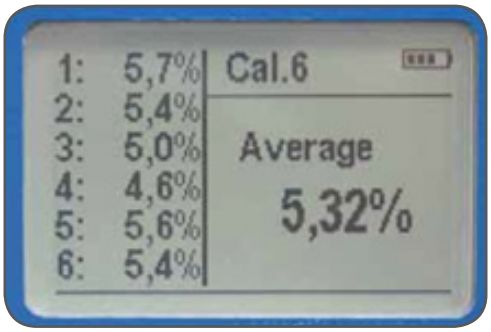
In order to initiate a measurement, shortly press the button "Measurement" The measurement will commence and a turning ymbol will appear instead of the accumulator-symbol in the upper right hand corner. During this period, no other actions can be performed. The measurement requires approximately 4 to 5 seconds. Once the measurement is concluded, the accumulator-symbol will reappear. On the left hand side of the display, the individual values of the measurements will be presented. The currently measured value is presented at Position 1 and old values will be shifted one position onwards. The arithmetic average value is displayed on the right hand side. The average value is calculated out of the existing individual values up to a number of 6 values.

Notice: Only a maximum of 6 values can be stored in the list. Older values are removed from the list and are no longer involved in the formation of the average value.

In order to delete the measurement series, actuate the button „Down"

TIPP:



Within the operating mode "Average Value", the HD2 will deliver a representative measurement result of all measured locations that represents significant volume of the material.

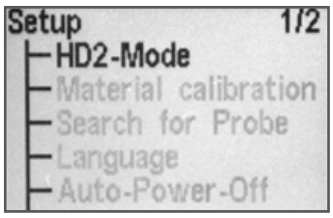
4.3.3 Operating Mode „Continuous Measurement"

In this operating mode, the measurement variables Moisture, Temperature, and the EC-Trime are determined. The continuous measurement is initiated by actuating the button „Measurement" he same is concluded by actuating the button „Measurement" once more. The currently pending measurement is performed completely once more and the sequence is concluded.

4.4 Settings

There are various options to modify and align the settings of the HD2 portable measuring instrument. You will reach the following menu configuration by actuating the button „Settings"

By actuating the buttons „Up" and „Down" the entry intended for processing can be marked and subsequently be selected with the button "Measurement" . You can exit the current menu item, and also the menu "Settings", with the button "Settings"



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Settings (German/English)	Designation
HD2-Modus HD2-Mode	Switching the Operating Mode - „Normal“ → measurement of the variables Moisture, Temperature, and EC-Trime - „Average Value“→determination of the average value of up 6 individual moisture measurement values - „Continuous Measurement“ → ditto
Materialkalibrierung Material calibration	Choosing the needed Material Calibration
Sonde suchen Detect Probe	A new search for a connected probe (if an error has occurred during the activation of the device)
Sprache Language	Switching the System Language -German -English
Auto-Power-Off	Setting of the automatic shut-down
Displaybeleuchtung Display Illumination	Setting of the Background Illumination - Turn-Off-Time - Intensity
Displaykontrast LCD-Contrast	Setting of the ideal contrast
Sondeninfo Probe Info	Issues various information regarding the probe
HD2-Info	Issues various information regarding the HD2 portable measuring instrument

4.4.1 HD2-Mode

In this menu item, the operating mode of the HD2 portable measuring instrument can be changed. With the selection „Normal“, an individual measurement of the three probe parameters Moisture, Temperature and the EC-Trime is selected. The parameter Moisture, depending on the selected calibration, the moisture in volumetric or gravimetric percentages or can state the running period of the TDR pulse. In case of the display of the running period, the percent-symbol must be understood as „ns“. When selecting “Average Value”, depending on the selected calibration, only the moisture in %vol or %grav, respectively the running period in ns, is determined. The measured value is stored in a list of up to 6 measurement values. The arithmetic average is formed out of this list.

Notice: Only a maximum of 6 values can be stored in the list. Older values are removed from the list and are no longer involved in the formation of the average value.

By actuating the buttons „Up“ ▲ and „Down“ ▼, the entry intended for processing can be marked and subsequently be selected with the button “Measurement’ ↻ After the selection, the symbol 💾 will appear in the upper right hand display corner which indicates that the selection is activated and has been stored.

4.4.2 Material Calibration

Depending on the task of the deployment, various calibrations are deposited in the probe. These can be volumetric calibrations for grounds of various densities, gravimetric calibrations for the measurement of sand moisture contents, or also running period calibrations.
You can select the calibration required for your application within the menu item „Material Calibration“. This enables to cover a multitude of deployment options with merely one probe.
After the selection of the menu item „Material Calibration“, the 15 calibration options are called up by name which requires a short moment of time. Subsequently a display in a similar form as follows will be generated:

The list can be scrolled and the wanted calibration be selected by actuating the buttons „Up“ ▲ and „Down“ ▼ The “!“ in front of a calibration indicates the currently active one. You can set the selected calibration to become the active one by actuating the button „Measurement“ ↻ After a short moment, the symbol 💾 will appear in the upper right hand display corner to indicate that the selection has been activated. In addition, the „!“ will be placed in front of the now active calibration.

4.4.3 Detecting Sensor/Probe

In the event that communication problems arise with the probe at the activation of the HD2 portable measuring instrument, or if no probe was connected, or it is intended to exchange the probe during operation, this menu item should be selected. After selection of this menu item, the HD2 will again attempt to establish a connection to the connected probe. If this attempt is successful, the serial number of the probe will appear in the display.

Should a connection not be possible, „No probe detected“ will be generated on the display.

Notice: Should no connection to the probe be possible in spite of several attempts, check if the probe is connected properly. Should this not deliver a positive result, please contact our service department.

4.4.4 Language

In this menu item, the language of the HD2 portable measuring instrument can be selected. Currently, the user has the choice between the languages English and German. You can select the desired language by actuating the buttons „Up“ ▲ and „Down“ ▼ and activate the same via the button „Measurement“ C. After activation of the language, the symbol 💾 will appear in the upper right hand corner of the display.

4.4.5 Auto-Power-Off

In the menu item „Auto-Power-Off“, you can select an automatic shut-down offered in various time periods.
Hereby, you can select between the following shut-off times:

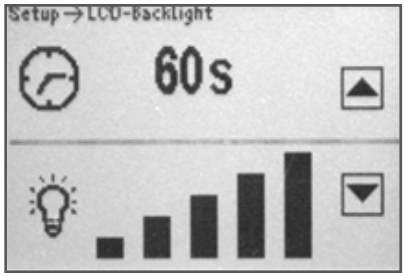
- 1 Minute
- 2 Minutes
- 5 Minutes
- 10 Minutes
- 20 Minutes

Respectively also deactivate the automatic shut-down function (Display „—min“). For this purpose, select the desired shut down time by actuating the buttons „Up“ ▲ and „Down“ ▼ and activate the same via the button „Measurement“ C. After activation, the symbol 💾 will appear in the upper right hand corer of the display.

Notice: The HD2 will only automatically shut down, if no further button is actuated. Any actuation of a button will lead to the shut down time to start again.

4.4.6 Display Illumination

If required, the background illumination of the display can be individually adjusted. Consequently, this enables the option to save power and to prolong the operational period.
After the selection of the menu entry, the following screen will be presented on the display:



The selection of the background illumination, respectively the time until the automatic shut-down of the same is selected via the button „Up“ ▲ by actuating the same several times. Using the button „Down“ ▼ you can adjust the intensity of the illumination, respectively turn the same completely off. Activate and store your settings by actuating the button „Measurement“ C. After activation, the symbol 💾 will appear in the upper right hand corner of the display.

4.4.7 Display Contrast

At extreme temperatures, it may be necessary to adjust the contrast of the display in order to be able to clearly read the display. For this purpose, select the menu item „Display Contrast“ and then change the contrast by actuating the button „Up“ ▲ respectively „Down“ ▼ Activate and store your settings by actuating the button „Measurement“ ↻ After activation, the symbol 💾 will appear in the upper right hand corner of the display.

4.4.8 Probe Info

By selecting this menu item, after a short moment, you will be issued various information regarding the connected probe.

These are:
- Serial Number
- Probe Type
- Hardware Version (HW)
- Firmware Version (FW)

4.4.9 HD2-Info

By selecting this menu item you will be issued various information regarding your HD2 portable measuring instrument.

These are:
- Serial Number
- Hardware Version (HW)
- Firmware Version (FW)
- Accumulator Capacity
- Accumulator Voltage

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5 Technical Data HD2

Height		36mm
Width		64mm
Length		150mm
Weight		(With accumulator) app. 437g
Power Consumption	Power Down	ca. 35µA
	Idle - Background Illum. OFF - Background Illum. Max	ca. 26mA ca. 56mA
	Probe turned ON	ca. 100mA
	Measurement	ca. 350mA
Measurement per Charge	20°C / Background Illum. Max Mode – Continuous Measurement	ca. 5000
Connectable Sensors	PICO64, PICO32, PICO-IPH	
Storage Temperature	-30°C bis 80°C	
Operating Temperature	-20°C bis 70°C	
Charging Temperature	10°C bis 30°C	
Charging Voltage	Nom. 12V, Max. 15V, Min. 12V	
Charging Current	ca. 1A	
Charging Time	At exhaustively discharged accumulator. 2h	
Accumulator	Ni-MH (4 x 1.2V) (AA), 2000mAh, >1500 Measurements	
Physical BUS	RS485	
Bus-Protocol	IMP-BUS-Protocol II	
IMP-Bus Port Settings	8 Data Bits, 2 Stop Bits, Odd Parity	

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6 Handling of the TRIME-PICO Probes

6.1 Introduction

The determination of the soil moisture content with the Time Domain Reflectometry (TDR) technology has in the mean time managed to well-establish itself on the market. In former times, the reliable measurement of the moisture was laborious and not always accurate. Since the development of the TRIME-TDR technology, there no longer any reason to rely on complicated and inaccurate technologies.

6.2 Measurement Volume of the PICO Probes

The penetration depth of the electrical and magnetic flux lines in theory reach indefinitely far into the measured material. However, the effective penetration depth of the PICO probes relevant for the measurement is approximately 2cm in the vicinity of the probe rods. The illustration demonstrates the effectively registered measurement volume.

For this reason, it is important to completely insert the probe rods in the material intended for measurement.

Not like that!

That's right!!

Probe rods are fully in the material

6.3 Measurement of laboratory samples in the bucket

A sample of material can also make easy in a plastic bucket. Due to the measurement field expansion (green waves in the figure) is a bucket with 10 liters as below to select. Thus the insertion of the probe enough space is available to the bucket, the bucket should have a suitable height. We recommend a plastic bucket with a diameter of 30cm and a height of 30cm. Please note the following:

1. The bucket should be filled at least 5 cm higher than the probe rods are long (<20cm),so that the probe be pressed in the material.
2. Insert the probe rods straight in the middle of the bucket into the material. It is important to make sure that is not wobbled to produce no air gaps between the bars.
3. Insert the probe so far into the material that the blue probe body is in the material.
4. To avoid air gaps stomp the bucket a few times on the ground to compress the sand around the probe rods.
5. After completion of the measurement, you can still carry out further measurements. To obtain a representative measurement, the sand is again agitate well.

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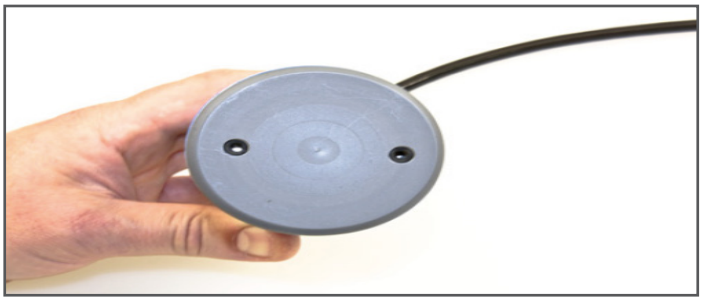
7 Exchange of the Probe Rods

In the event that the probe rods are damaged, the same can be easily exchanged.

1) Prepare the gaskets, the probe body, and the probe rods

2) Press the gaskets into the bore holes



3) Press the gaskets until they reach the interior thread

4) Screw the rods into the probe body

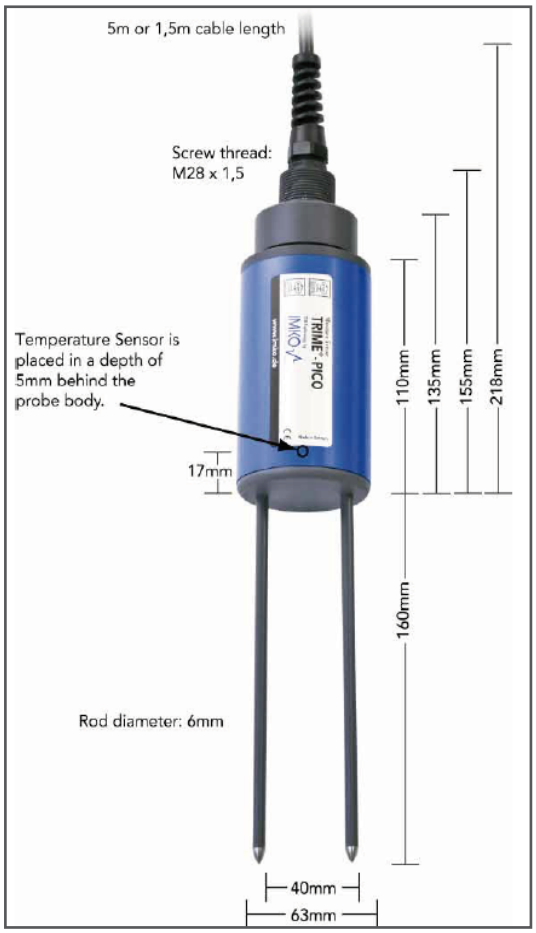
HD2 – Mobile Moisture Meter

8 Technical Data TRIME-PICO probes

8.1 TRIME-PICO64

For measurement of the moisture content in soil, sand, and gravel

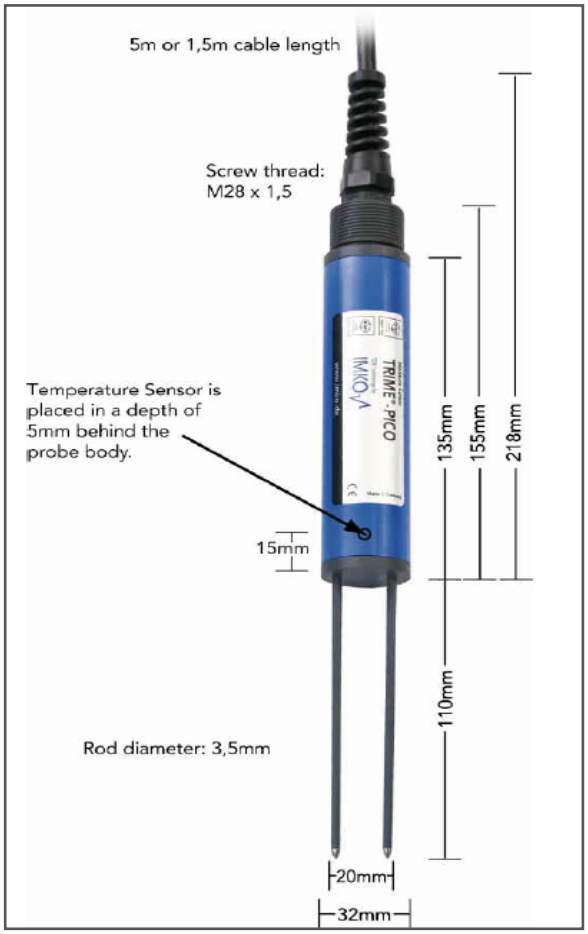
- State-of-the-art sensor with integrated TDR- electronics
- Measurement Value Range 0..100 vol.%
- Integrated Temperature Sensor
- Deployable up to more than 20dS/m Total Conductivity (Bulk-Soil-Conductivity).
- Measurement Volume 1250ml
- Robust (IP68), proven, and suited for long-term in- stallation



8.2 TRIME-PICO32

For measurement of the moisture content in soil, sand, and gravel

- State-of-the-art sensor with integrated TDR- electronics
- Measurement Value Range 0..100 vol.%
- Integrated Temperature Sensor
- Deployable up to more than 20dS/m Total Conductivity (Bulk-Soil-Conductivity).
- Measurement Volume 250ml
- Robust (IP68), proven, and suited for long-term in- stallation



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Technical Data

	TRIME®-PICO64			TRIME®-PICO32			TRIME®-PICO IPH T3/44		
Power supply:	7V..24V-DC								
Power consumption:	100mA @ 12V/DC during 2..3sec. of measuring								
Moisture measuring range:	0..100% volumetric water content								
Accuracy (in % volumetric water content):									
conductivity range:	0..6dS/m	6..20dS/m	>20dS/m	0..6dS/m	6..20dS/m	>20dS/m	0..6dS/m	6..15dS/m	>15dS/m
Moisture range 0..40%:	±1%	±2%	with material specific calibration	±1%	±2%	with material specific calibration	±2%	±3%	with tube access probe T3C/44
Moisture range 40..70%:	±2%	±3%		±2%	±3%		±3%	±4%	
Repeating accuracy:	±0.2%	±0.3%		±0.2%	±0.3%		±0.3%	±0.5%	
Temperature caused drift of electronics (full range):	±0.3%								
Soil temperature measuring range:	-15°C...50°C								
Soil temperature measuring accuracy:	±0,2°C								
Measurement volume:	1,25L ≙ 160x100mm diameter			0,25L ≙ 110x50mm diameter			3,0L ≙ 180x150mm diameter		
Operating Temperature:	-15°C...50°C (extended temperature range on request)								
Calibration:	Calibration for a wide range of standard soil types (in accordance with Topp (equation))								
	standard calibration for most soils, customizable material specific calibration, storage of up to 15 user defined calibration curves, calibration of dielectric permittivity is possible			standard calibration for most soils, customizable material specific calibration, storage of up to 15 user defined calibration curves, calibration of dielectric permittivity is available			standard calibration for most soils, customizable material specific calibration, storage of up to 15 user defined calibration curves, calibration of dielectric permittivity is possible		
Probe body:	waterproof sealed PVC (IP68)								
Size:	155 x Ø63mm			155 x Ø32mm			166 x Ø32mm		
Rod lenght:	standard: 160mm			standard: 110mm			standard: 180mm		
Rod diameter:	6mm			3,5mm			—		
Interfaces:	IMP-BUS RS485 Analogue output: 2x 0..1V, 0(4)..20mA[1] 0..100% vol. water content -40..+70°C soil temperatur						— RS485 Analogue output: 2x 0..1V, 0(4)..20mA[1] 0..100% vol. water content -40..+70°C soil temperatur		
Option 1 (RS485 & analogue):	1,5m cable with 7-pin female connector						3,5m cable with 7-pin female connector		
Option 2 (IMP-BUS):	1,5m cable with 7-pin female connector						—		
Option 3 (all interfaces):	5m cable with end splices (all interfaces)						—		

Optional available for cable extension: E-BOX (cable extension box)
[1]Optional available for cable extension and current output: C-BOX (0..1V to 0(4)..20 mA converter box)